

Kohl: A Lead-Hazardous Eye Makeup from the Third World to the First World

by Carol Parry* and Joseph Eaton*

Kohl is a widely used traditional cosmetic. It is mainly worn around the eyes in Asia, Africa, and the Middle East. It may be a pervasive source of lead poisoning in those areas and among individuals from those areas who have immigrated to developed nations. Samples of kohl were purchased in Morocco, Mauritania, Great Britain, and the United States. Some of these samples originated from Pakistan, India, and Saudi Arabia. Kohl is widely believed to consist of antimony, but analysis consistently revealed only trace amounts of antimony. Nine of the twenty-two samples tested contained less than 0.6% lead; however, seven samples had lead levels in excess of 50%. The remainder ranged from 3.31 to 37.3%. Third-world-manufactured kohls were purchased in the United States and Britain, suggesting that this hazard is no longer confined to the third world. Those kohls that contained lead were sold in violation of laws on lead in cosmetics in both of these nations. Third-world physicians and health care workers appear to be unaware of possible lead uptake from unsuspected traditionally used items. Physicians in developed nations with patients from Asia, the Middle East, and North Africa need to factor in the possibility of past or present lead intake from unorthodox sources such as kohl.

Introduction

Kohl is a cosmetic predominantly used as an eye makeup. It is widely used by women, men, and on children and babies in Asia, the Middle East, and most areas of Africa except South Africa. It is worn for a variety of reasons including tradition, beautification, to ward off the "evil eye," the widespread belief that kohl is medically beneficial for the eyes, and finally because wearing kohl is encouraged within the sunna, the traditional behavioral guidelines of the Islamic religion.

This study was undertaken to ascertain whether this substance is a possible source of lead exposure, to determine if individuals from third-world nations were continuing to use this product in first-world nations, and to confirm commercial availability of this substance in first-world nations.

Testing Method

Twenty-two samples of kohl in its natural form and processed into powder were purchased in London, Rabat (Morocco), Nouakchott (Mauritania), Detroit, Pittsburgh, and New York City. They were tested for lead and antimony at the Wisconsin Occupational Health Laboratory, State Laboratory of Hygiene. A portion of the sample was weighed and then digested with an appropriate acid or acids. The digested portion was diluted to volume and then run on a Jarrell-Ash Plasma fission Spectrograph (Table 1).

Sampling

Samples of kohl were purchased in Rabat, Morocco, and Nouakchott, Mauritania, in the local *souks* (markets). Kohl was widely available, the average bottle cost less than \$1.00. Kohl was sold in powder form in black, grey, pink, blue, green, gold, silver, and yellow, and it was also available in natural unprocessed form as pieces of galena, or lead sulfide.

In London, Detroit, Pittsburgh, and New York City, samples were bought at local ethnic stores catering to immigrant Asian, Middle Eastern, and African communities. The only colors available were black and grey. The cost averaged \$2.00 a bottle. In addition to kohl, these stores usually carried imported food products, spices, and cooking and eating utensils.

Results

Of the 22 samples tested, 7 contained in excess of 50% lead, 5 contained more than 20% lead, 1 contained 3.31%, and the remaining 9 contained less than 0.6% lead. Four samples with lead in the 50% to 60%+ level were purchased in Nouakchott, Detroit, and New York City; however, they were all manufactured in Karachi, Pakistan. Of the four samples purchased in New York City, all four contained lead, including sample 10, which was labeled as especially formulated for use on babies. Two of these kohls were manufactured in Pakistan, and the other two were from India. Both samples bought in London, but originating from Mecca, Saudi Arabia, contained high levels of lead. None of the samples had labeling that indicated a list of ingredients or lead content. Without laboratory analysis, it is impossible for the consumer to differentiate high-lead from low-lead content when purchasing this product.

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Table 1. Lead and antimony content of kohl samples.*

Sample	Location	Origin	Lead, %	Antimony, %
1	Rabat	Domestic	69.6	< 0.1
2	London	Mecca	66.6	< 0.1
3	New York City	Karachi	61.92	< 0.1 ^b
4	Detroit	Karachi	60.6	< 0.1 ^b
5	Nouakchott	Karachi	60.6	< 0.1 ^b
6	Rabat	Domestic	57.8	< 0.1
7	New York City	Karachi	50.67	< 0.1
8	London	Mecca	37.3	< 0.1
9	Rabat	Domestic	27.9	< 0.1
10	New York City	Delhi	24.45	< 0.1
11	Rabat	Domestic	21.1	< 0.1
12	Rabat	Domestic	20.9	< 0.1
13	New York City	Delhi	3.31	< 0.1
14	Rabat	Domestic	0.59	< 0.1
15	Nouakchott	Pakistan	0.34	< 0.1
16	Detroit	Unknown	0.04	< 0.1
17	Nouakchott	Morocco	0.03	< 0.1
18	Rabat	Domestic	0.02	< 0.1
19	Rabat	Domestic	0.02	< 0.1
20	Detroit	Bombay	< 0.03	< 0.1 ^c
21	Nouakchott	Bombay	< 0.03	< 0.1 ^c
22	Pittsburgh	India	< 0.01	< 0.1

*Location refers to city where sample was purchased; origin refers to location where sample was manufactured, as determined by packaging, labeling, or interview at point of purchase.

^bThese samples are an identical manufactured product purchased in different locations.

^cThese samples are an identical manufactured product purchased in different locations.

Much of the literature on the Middle East and Arab cultural habits that mentions kohl identifies it as ground antimony (1-4). However, testing consistently found antimony levels of less than 0.1%. Excavations in the Middle East and Africa have frequently turned up ancient eye makeup containers, which occasionally have contained makeup. When tested, some of these eye makeups were composed primarily of ground antimony (5). However, evidence exists that suggests that the Pharonic Egyptians used kohl made from both antimony and ground lead sulfide (6). This now predominant use of lead sulfide in eye makeup may be a product substitution that has occurred over time. As antimony is scarce and expensive, lead sulfide in the form of galena is a cheap and readily available substitute that has gradually replaced it in manufacturing and in the markets.

Of the 10 samples purchased in London, New York, and Detroit, 7 had significant lead content. This is clearly in violation of restrictions on lead in cosmetics which exist in both Great Britain and the United States.

Discussion

In the third world, the lack of protective legislation, lax enforcement of existing legislation, and ignorance of the danger of exposure to even low levels of lead all contribute to the prevalence of lead in the environment from orthodox sources such as lead-based paints, pollution from manufacturing, and airborne lead from automobile exhaust. As development continues and industrialization and automobile usage increase, the lead pollution problem will only worsen.

There is good evidence to justify a broad study of the lead ingestion hazard from unorthodox sources in the third world and their importation into Western nations. A pilot project, "Teapots and Toxicity" (7), sampled pewter lead-soldered teapots, a

popular tourist souvenir from Morocco and Mauritania. Samples of these teapots were purchased in Morocco, Mauritania, Great Britain, and the United States. Testing is incomplete; however, preliminary tests suggest that these teapots are a lead hazard.

Previously unsuspected lead-hazardous items may be in common daily use in the third world. These could include pewter and other metal and low-fired ceramic cooking and eating vessels (8) and utensils, traditional medicines and cosmetics, and the widespread use of lead solder in a variety of applications including plumbing installation, cooking and eating equipment, and in jewelry. Public health officials and health care workers in the third world appear to be unaware of possibility of significant levels of lead exposure from these unorthodox sources.

In the United States, Canada, France, Great Britain, Germany, and other nations, immigrant neighborhoods often have local ethnic stores that carry familiar products often imported from home including traditional foods, utensils, medicines, and cosmetics. Importation of these items appears to be unregulated, in part because many of these items have never been tested for possible health hazards.

The substance known as kohl in the Middle East and Africa is identical to surma, a commonly used eye makeup in India, Iran, Pakistan, Bangladesh, Nepal, and southern regions of the USSR. Laboratory confirmation of the lead content in some Asian surmas already exists (9-11). Medical literature for more than 20 years has included detailed case studies of patients, most frequently infants and children, presenting with plumbism that upon investigation has been attributed to surma (12-15). In all of these cases, mothers or other well-meaning relatives applied surma to the children as a traditional measure to beautify and to protect the child from the "evil eye" (P. O'Gorman, G. J. Snodgrass, and M. A. Warley, personal communications). Sadly, a number of these cases resulted in fatalities (16).

Controlled studies by Healy and Aslam (11) have concluded that transcorneal transport does not occur. Lead absorption, in their opinion, is primarily alimentary. When applied to the conjunctival surfaces around the eyes, kohl is an irritant that produces a slight burning feeling and tearing. The subjects, especially children, often wipe their eyes and then fail to wash their hands afterwards. In children, finger sucking is very common, and this is the primary route of ingestion (11).

Great Britain outlawed the importation and sale of surma under the Cosmetic Products Safety Regulations 1984, and various educational campaigns were mounted to alert immigrant populations in Great Britain to the dangers of surma. Selected interviews conducted in Great Britain in December 1989 indicated that this educational campaign was only marginally successful (unpublished data).

Despite the fact that importation of surma is illegal, kohl was readily available in Great Britain. British Customs, when interviewed in 1989, stated that the majority of surma and kohl that enters Great Britain arrives in hand luggage from Asia and the Middle East. Although it is subject to seizure, the officials felt that because of the sheer volume of inspections necessary, there was little they could do to enforce the current laws (unpublished data).

The extent of lead absorption from all unorthodox sources remains to be determined. But there is certainly enough evidence that some kohl and surma contain more lead than is consistent with modern public health standards.

Conclusion

Kohl or surma appears to be a substance that may be a source of lead exposure in Asia, the Middle East, Africa, Europe, and the United States, and probably also among Asian, African, and Arab immigrant populations in South America and the Caribbean. Among the many millions of individuals who use it, kohl is a deeply held tradition and a culturally and religiously legitimized practice. Laboratory analysis of samples indicates wide variations in the lead content in kohl and no way of protecting the consumer from those that are hazardous.

Recent longitudinal studies confirm that subclinical levels of lead poisoning in childhood appear to be responsible for long-term subtle declines in intellectual and learning capacities, the effects of which persist long after the initial exposure to lead (17). In the third world, where kohl usage is widespread, could subclinical lead poisoning from intra-utero, infant, and childhood exposure to kohl have a lifetime negative effect on intelligence and learning abilities, not just on an individual basis, but with profound implications for the population? Could kohl be the cause of countless unexplained third-world infant deaths, and a significant contributory factor to early mortality (M. Healy, personal communication)?

On the global level, as third-world traditional practices are spread to developed nations by immigrants, developed nations need to review their legislation to curtail the importation of hazardous traditional third-world cosmetics, medications, and other items. This, in turn, would help to alert third-world governments to this issue and the need to respond with legislation and programs of their own.

Health care professionals in the third world as well as in developed nations whose patients include individuals from Asia, the Middle East, or Africa need to consider during diagnosis that these patients may have past or current exposure to lead origin-

ating from a variety of unorthodox sources, including traditional cosmetics and especially surma or kohl.

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